REMARKS

Applicant submits herewith an excess claim fee for two (2) additional dependent claims.

Claims 1-11, 13-15, 17, 18, and 21-35, are all the claims presently pending in the application. Applicant has canceled claims 16, 19, and 20 without prejudice or disclaimer. Applicant has added new claims 30-35 to more particularly define the invention. Claim 6 stands rejected under 35 U.S.C. § 112, second paragraph. Claims 1-11 and 13-29 stand rejected on prior art grounds. Reconsideration is respectfully requested.

Claims 1-11, 13-18, 20, 22, 23, 25, 28, and 29 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Muramatsu (JP 05-323355). Claims 21, 24, 26, and 27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Muramatsu (JP 05-323355) in view of Toyosawa, et al. (U.S. Pub. 2002/0033524).

This rejection is respectfully traversed in view of the following discussion.

It is noted that the amendments are made only to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed, for example by independent claim 1, is directed to a tape carrier type semiconductor device.

The device includes a flexible substrate on whose surface wiring is formed, and a driver circuit which is mounted on the flexible substrate and drives a device connected to the flexible substrate. The flexible substrate includes a first slit for releasing stress, the first slit having a connector situated intermediate thereto for connecting both sides of the first slit to reduce warpage, and a second slit having no connector, for folding the flexible substrate. (See Page 6, lines 5-17; Page 9, lines 1-2; and Figures 1, 2, 4 and 9).

Similarly, for example, independent claim 10, in part, recites, "a first slit for releasing stress in the flexible substrate, the first slit having a connector for connecting both sides of the first slit, a second slit having no connector, for folding the flexible substrate."(See Page 6, lines 5-17; Page 9, lines 1-2; and Figures 1, 2, 4 and 9).

Similarly, for example, independent claim 13, is directed to a flexible substrate. The flexible substrate includes a first slit for releasing a stress, the first slit having a connector thereto for connecting both sides ends of the first slit, and on whose surface wiring having a predetermined pattern is formed, and a second slit having no connector, for folding the flexible substrate. (See Page 6, lines 5-17; Page 9, lines 1-2; and Figures 1, 2, 4 and 9).

Conventional tape carrier-type semiconductors tend to have a stress-releasing slit, which does not include two sub-slits and a bridge, and may include a reinforcement plate. However, neither configuration prevents warpage caused by the different heat expansion coefficients of the resin on one surface of the flexible substrate and the solder resist applied to the other side of the flexible substrate. Thus, the warpage may prevent the tape carrier

III. THE PRIOR ART REJECTIONS

A. The § 102(b) Rejection Based on Muramatsu

Regarding claims 1-11, 13-15, 17, 18, 22, 23, 25, 28 and 29, Applicant submits that there are elements of the claimed invention which are neither taught nor suggested by Muramatsu ("Muramatsu"). Muramatsu fails to teach or suggest, including the flexible substrate includes a first slit for releasing stress, the first slit having a connector situated intermediate thereto for connecting both sides of the first slit to reduce warpage, and a second slit having no connector, for folding the flexible substrate as recited in independent claim 1, and similarly independent claim 10. Muramatsu also fails to teach or suggest a similar feature, including a first slit for releasing a stress, the first slit having a connector thereto for connecting both sides ends of the first slit, and on whose surface wiring having a predetermined pattern is formed, and a second slit having no connector, for folding the flexible substrate as recited in independent claim 13. (See Page 6, lines 5-17; Page 9, lines 1-2; and Figures 1, 2, 4 and 9).

Instead, Figures 1-10 of Muramatsu merely disclose a mounted structure of an LSI tape carrier including a tape 1 and a plurality of slits 5 (what the Examiner attempts to analogize to a stress-releasing slit), oriented transverse to the direction of the tape 1. In particular, tape 1 comprises a plurality of slits 5, as shown in, for example, Figure 1. The slit 5 is used for folding the tape 1, as shown in, for example Figure 5. However, Muramatsu does not disclose to provide a stress-releasing slit apart from the folding slit 5.

As known from Figure 1 of Muramatsu, the slit 5 is also provided at a portion denoted by the reference numeral 4 in Figure 5. However, the reference numeral 4 denotes an input terminal, and the input terminal 4 is connected to a circuit substrate 9. Therefore, the slit 5 at the portion denoted by the reference numeral 4 does not function as a stress-releasing slit.

Further, in a situation where the connectors are provided at the intermediate of a slit, the greater the number of such connectors makes it harder to fold a substrate (tape). According to the present invention, connectors are provided to the stress-releasing slit 7, while no connector is provided to the folding slit 6. To the contrary, according to Muramatsu, a connector 6 is provided at the intermediate of the folding slit 5, as illustrated.

Contrary to the assertion in the Office Action, the slits 5, as indicated, are more structurally and functionally equivalent to folding slits not stress releasing slits as suggested in the Office Action. (See Office Action, Page 2, last paragraph). Accordingly, the "folding slits" 5 tend to facilitate the folding of the tape carrier like the conventional art. Indeed, the slits are more equivalent to folding slits than stress releasing slits as the slits function to reduce tensile force in the length direction of the tape similar to the conventional art cited by Applicant. (See Detailed Description, Paragraphs [0003] and [0010]; Application, Page 1, lines 18-21; and Figure 10A). Therefore, the folding slits are not equivalent to Applicant's stress-releasing slits, which reduce stress due to different heats of expansion from a resin on one surface of the flexible substrate and a solder resist on the other surface of the flexible substrate.

Please note, in Muramatsu, the LSI circuit 2 is separated from either the LCD 7 or the electronic printing element 105 by the folding slits 5 situated at the folding portion of TAB 21, and thus these elements are not adjacent.

Finally, for emphasis, in Applicant's invention the folding slits 6 may be formed between the driver circuit 3 and the LCD 8B but not between the driver circuit 3 and the print substrate 8A like Muramatsu's invention as depicted in Figure 9. Based on Applicant's configuration, only the stress-releasing slit 7 is situated adjacent to the printing substrate 8A

and the driver circuit 3 whereas neither a stress-releasing slit nor a folding slit is adjacent to the driver circuit and the printing substrate in Muramatsu. At best in Muramatsu, a folding slit is situated intermediate between a electronic printing element 105 and an LSI circuit 2. Therefore, for emphasis, Applicant's stress-releasing slits are thermal stress-releasing slits, for example as recited in claim 30, which reduce warpage of the tape carrier, due to "a difference in heat expansion coefficients" of the solder resist and resin each formed on a separate surface of the flexible substrate. Thus, Applicant's configuration prevents the outer terminals from being detached from the print substrate and the LCD. (See Page 5, line 27-Page 6, line 26; Page 9, lines 1-2; and Figures 1, 2, 4 and 9).

Muramatsu, therefore, does not teach, suggest or disclose including the flexible substrate includes a first slit for releasing stress, the first slit having a connector situated intermediate thereto for connecting both sides of the first slit to reduce warpage, and a second slit having no connector, for folding the flexible substrate as recited in independent claim 1, and similarly independent claim 10. Muramatsu also fails to teach or suggest a similar feature, including a first slit for releasing a stress, the first slit having a connector thereto for connecting both sides ends of the first slit, and on whose surface wiring having a predetermined pattern is formed, and a second slit having no connector, for folding the flexible substrate as recited in independent claim 13.

For at least the reasons outlined above, Applicant respectfully submits that Muramatsu does not disclose, teach or suggest all the features of independent claims 1, 10 and 13, and related dependent claims 2-9, 11, 14-15, 17-18, 22, 23, 25, 28 and 29. Withdrawal of the rejection of claims 1-11, 13-15, 17-18, 22, 23, 25, 28 and 29 under 35 U.S.C. § 102(b) as anticipated by Muramatsu is respectfully requested.

B. The § 103(a) Rejection of Muramatsu in view of Toyosawa, et al.

Regarding claims 21, 24, 26 and 27, first, the references, separately, or in combination, fail to teach, disclose or provide a reason or motivation for being combined. In particular, Muramatsu pertains to a mounted structure of an LSI tape carrier including deformable folding slits, and ribs, to reduce tensile force due to the length direction of the tape. (See Muramatsu at Abstract; and Detailed Description, Paragraphs [0003] and [0010])

By contrast, Toyosawa, et al. ("Toyosawa") does not have the same aim as Muramatsu.

Toyosawa discloses a tape carrier package and an LCD using a copper wiring pattern, which attempts to increase flexibility and reduce disconnection in the metal wiring pattern upon packaging for use with the LCD. (See Toyosawa at Abstract; Column 1, Paragraph [0001]; and Column 4, Paragraph [0043] and [0044]).

Nothing within Toyosawa, which pertains to increased flexibility and reduced disconnection in the copper wiring pattern, has anything to do with attempting to solve the problem of increased tensile force due to the length direction of the tape as disclosed in Muramatsu. Thus, Muramatsu teaches away from being combined with another invention, such as, Toyosawa.

Therefore, one of ordinary skill in the art would not have combined these references, absent hindsight.

Second, even if combined, the references do not teach or suggest the features of independent claim 1, including the flexible substrate includes a first slit for releasing stress, the first slit having a connector situated intermediate thereto for connecting both sides of the

first slit to reduce warpage, and a second slit having no connector, for folding the flexible substrate as recited in independent claim 1. (See Page 6, lines 5-17; Page 9, lines 1-2; and Figures 1, 2, 4 and 9).

First, Muramatsu, as discussed above, does not disclose, teach or suggest the above feature of Applicant's invention.

Second, the Examiner clearly indicates that Muramatsu also does not disclose, teach or suggest that "the flexible substrate comprises a resin on a first side of the flexible substrate, the resin including a first heat expansion coefficient," for example, as recited in claim 26. Further, as indicated, Muramatsu does not teach or suggest that "the flexible substrate comprises a solder resist on a second side of the flexible substrate, the solder resist including a second heat expansion coefficient," for example, as recited in claim 27. (See Office Action at Page 4, 4th Paragraph-Page 5, 1st Paragraph).

Third, Toyosawa does not make up for the deficiencies of Muramatsu.

Toyosawa does not disclose a feature of claim 1, including the flexible substrate includes a first slit for releasing stress, the first slit having a connector situated intermediate thereto for connecting both sides of the first slit to reduce warpage, and a second slit having no connector, for folding the flexible substrate. Toyosawa also does not disclose the features of claims 21, 24, 26 and 27 of Applicant's invention. In addition, the Office Action does not assert or suggest that Toyosawa includes such features.

Instead, Figure 1(b) of Toyosawa discloses a tape carrier package 23 and an LCD comprised of a copper wiring pattern, which includes "a pair of slits 25 that are through holes" where solder resist 30 covers the slits to form bending portions. (See Application, Page 2, Paragraph [0021]; Page 8, Paragraphs [0113] and [0119]; Page 9, Paragraph [00135];

and Figures 1(b), 6, 12(a) and 12(b)). The slits are a continuous rectangular shape oriented perpendicular to the length of the tape carrier without any sub-slits with an intermediate connector. Thus, the slits are bending portions. (See Office Action, Page 4- Page 5; and Toyosawa at Abstract; Column 1, Paragraph [0001]; Column 4, Paragraph [0043] and [0044]; and Column 16, Paragraph [0119]).

Accordingly, Toyosawa attempts to provide a significant amount of flexibility through this structure while attempting to reduce disconnection in the metal wiring pattern upon packaging for use with the LCD. Applicant respectfully asserts that the Office Action mischaracterizes Toyosawa because Toyosawa only teaches slits used as through holes but does not disclose, teach or suggest, including a first slit having a connector situated intermediate thereto for connecting both sides of the first slit to reduce warpage, let alone, the first slit comprises a stress-releasing slit as recited in Applicant's invention.

For emphasis, Toyosawa teaches a copper wiring pattern with slits used as through-holes without any print substrate whereas Applicant teaches the flexible substrate is connected to a print substrate where the first slit is a stress-releasing slit adjacent to a driver circuit and a print substrate. Further , Toyosawa only teaches that the slits are continuous without any intermediate connector whereas Applicant teaches that the stress releasing slit comprises a first sub-slit and a second sub-slit with an intermediate connector.

Consequently, the conventional Muramatsu and Toyosawa structures are unsuitable for achieving at least one object of the invention, which includes reducing "the warp of the tape carrier type semiconductor device" caused by the two different heat expansion coefficients of the resin and the solder resist exerted on the flexible substrate during manufacturing, and thus preventing the outer terminal from detaching from the print substrate

and the liquid crystal panel. Therefore, the tape carrier type semiconductor device is easily manufactured and unlikely to warp. (See Page 1, line 27-Page 2, line 3; Page 2, lines 24-26; Page 3, lines 9-13; Page 6, lines 5-17; Page 8, lines 10-15; Page 8, line 25-Page 9, line 6 and lines 17-23; and Figures 1, 2 4 and 9).

Finally, please note, Applicant traverses the assertion in the Office Action that the warpage percentage of the tape carrier as recited in claims 24 is not critical and can be determined by routine experiment. Based on Applicant's configuration, which includes a stress releasing slit with a bridge, the amount of warp is equivalent to 4.8% of the length of the tape carrier device compared to a conventional device (i.e, not Applicant's configuration), where the warpage is approximately 30%. This reduction in warpage is more than a 100% reduction. Accordingly, this result is particularly significant, as indicate above, as the reduced warpage prevents the outer terminal from detaching from the print substrate and the liquid crystal display while simplifying the manufacturing process as recited in the specification. (See Application, Page 7, line 26-Page 8, line 15).

Contrary to the assertion in the Office Action, since Muramatsu, Toyosawa, nor the conventional art teach or suggest Applicant's invention, one of ordinary skill in the art could not simply produce Applicant's reduced warpage of only 4.8% by simple experimentation, particularly as neither Muramatsu nor Toyosawa are focused on reducing warpage due to thermal stress. Indeed, neither reference discloses or teaches any reduced warpage percentage, let alone, a reduced warpage of 4.8 percent. Thus, neither reference teaches Applicant's invention, including the feature of claim 24.

For at least the reasons outlined above, Applicant respectfully submits that neither Muramatsu nor Toyosawa teach or suggest all of the features of the independent claim 1, and

related dependent claims 21, 24, 26 and 27, which are patentable not only by virtue of their dependency from their respective independent claims, but also by the additional limitations they recite.

For the reasons stated above, the claimed invention, and the invention as cited in independent claim 1, should be fully patentable over the cited references.

IV. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1-11, 13-15, 17, 18, and 21-35, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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